Phylum Platyhelminthes
Flatworms

The Acoelomates

The acoelomates are animals that lack a coelom. Acoelomates lack a body cavity, and instead the space between the body wall and the digestive tract is filled with muscle fibers and loose tissue called parenchyma. These animals possess three living cell layers (i.e.: ectoderm, mesoderm, and endoderm) which makes them triploblastic.

The acoelomates are advanced over other radiate animals in several ways:

1. Their bilateral symmetry adapts them for direct movement.
2. Their tissues are well defined and organized into complex organs.
3. The nervous system is organized and concentrated in the anterior end of the animal (cephalization).
4. They do not depend on simple diffusion for elimination of nitrogenous wastes, but have an excretory system based on structures called flame cells.
5. They possess a complex digestive tract with both a mouth and anus.

Class Turbellaria (Planarians)

Planarians are found on the underside of stones and submerged leaves or sticks in freshwater springs and ponds. They are often confused with leeches, which they resemble in size, shape and color. Unlike leeches planarians are not segmented and usually do not resort to blood meals.

Observation of stained Turbellaria

- View the stained whole mount of planaria. The slide is labeled “Digestive tract.” Note in the center of the specimen a clear unstained area, this is the eversible pharynx. Ingestion of food occurs through sucking action by the pharynx. Sketch and label the digestive system in your preparation.
- Obtain a slide of a cross section of Planaria. Sketch and label the appropriate structures. Use the schematic to the right as a guide.

The appearance of your cross section will depend on whether it was taken from the anterior, middle, or posterior section of the animal. On all preparations you should be able to view the epidermis. This is the structure, which is responsible for secreting mucus that the flatworm slides across.

Inside the epidermis is a layer of circular and longitudinal muscles. These help the animal stretch and contract its length. Attempt to find the 2 nerve cords on the ventral surface. This is part of the ladder and ganglia nervous system we discussed in class.

In the cross section view you should note the parenchyma. This tissue fills the body cavity between the organs and epidermis.
Observation of live Planarians

- Gently, using forceps, an eyedropper or a finger, place a live planarian in a petri dish with the spring water provided. Periodically replace the water as it evaporates.

EXTERNAL STRUCTURES

- Observe the animal and decide which is the anterior, posterior, dorsal and ventral surface. Briefly, hold the specimen over a microscope lamp and locate the muscular pharynx along the midline of the body. It uses this structure to feed. Draw and label your specimen as provided in the diagram to the right.
- On your live specimen note the ear-like auricles. These structures bear sensory cells but they are tactile not auditory nor olfactory. Note the eyes, do they possess lenses?

LOCOMOTION

- Note how your specimen moves across the petri dish. This gliding movement is accomplished in part by mucus on which the planarian moves via cilia. The body is also propelled by waves of muscle contractions. Note how the animal will shorten and lengthen its body length to accomplish movement.

REACTIONS TO STIMULI

- Observe the responses of planarians to touch (thigmotaxis) and light (phototaxis) through the following experiments:
  - Response to touch. Very gently touch the outer edges of the worm with a probe or pencil. Which parts of the body are the most sensitive?
  - Response to directional illumination. Direct a strong light at the planarians from one side of the dish and observe their movements. Periodically, move the dish around the light pausing to note the animal's response. Is the response random or directional?

Class Trematoda (Flukes)

All trematodes are parasitic, harbored in or on a great variety of animals. Many have two intermediate hosts before reaching the final host.

Study of prepared slides:

- Examine a slide of both male and female Schistosoma. An odd feature of this genus is the strong sexual dimorphism. The males are stouter than the females and have a longitudinal groove called the gynecophoric canal. Even odder, the thinner female normally resides there, permanently embraced by the male. Note the strong oral sucker and secondary sucker near the anterior end. Draw and label both male and female specimens.
- Examine a stained slide of Clonorchis. Sketch and label the structures you can discern. Use the schematic to the left as your guide.
Class Cestoda (Tapeworms)

Tapeworms are all endoparasitic and show extreme adaptations to their existence through the complete loss of their digestive tract, and a focus on reproduction. Most require a single intermediate host and a final host, where the adult tapeworm resides.

As their name implies their long bodies are usually made of segments called proglottids. As new proglottids are formed anteriorly the older ones are pushed towards the tail, hence the maturest proglottids are found at the posterior end. The scolex is located on the head and is used for attachment.

- Examine the preserved slides of Dipylidium. Attempt several sketches of the scolex and suckers, which are used for attachment. Sketch both mature and immature proglottids if present. Label the structures you can discern. Use the schematic below as your guide.

Since tapeworms are hermaphroditic each proglottid contains both male and female gonads. The mature proglottid contains a genital pore laterally (on the side). From this pore two tubes extend into the interior. The anterior, convoluted tube, which branches in the middle of the proglottid, is the sperm duct. It branches to the different testes in the segments. The posterior duct is the vagina, which connects to the ovaries via the oviducts.
Planarian Regeneration Experiment

As we learned in class planarians have incredible powers of regeneration. It's now time to make some cuts!!

Pair-up into groups of two and prepare the following materials:
1. Clean razor blade or sharp scalpel
2. A clean petri dish with cover and partially filled with spring water
3. Obtain two flatworms per group

PROCEDURE

- Using a pair of forceps, place the planarian on a piece of tissue paper and place both on a cube of ice. The planarian will immediately extend and become catatonic.
- Place the ice, tissue paper, and planarian under a dissecting microscope and decide how you want to cut your worms. *Use the drawings below as some possible suggestions.*

![Planarian Diagrams]

- If you decide to make longitudinal cuts make sure the cut is clean and has completely separated the cut surfaces.
- Place the cuts and cut planarians into the petri dish (with your name on the cover) and place in a cool place.
- To insure the health of our specimens the water must be changed every 3 days with fresh spring water. At each water change remove any dead pieces which will appear fuzzy and gray.
- Use the attached tables on the following page to sketch your initial cuts.
- At each water change (every 3 days) examine and sketch the regeneration of new body parts. Observe the specimens for 1 week.
- **Important:** If you make longitudinal cuts for 2 headed worms, you will need to renew the cuts 1 and 2 days after the initial incisions. This is done to prevent the two pieces fusing back together.
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Review Questions: Platyhelminthes

1. Tapeworms have segments called_________________ and a head called______________.

2. What are the differences between male and female Schistosoma?

3. What structures do flatworms use to remove metabolic waste from the body?

4. How many germ layers do members of the phylum Platyhelminthes possess? What are they called?

5. Typically, how many intermediate hosts do trematodes infest before reaching the adult stage in the final host?